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BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Project

Date

Author

TITLE

PROGRESS REPORT FOR CALENDAR YEAR 1939

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Federal Building
Coeur d'Alene, Idaho

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MISSOULA
FOREST INSECT
LABORATORY

SUBJECT--

INDEX No.--

ANNUAL PROGRESS REPORT

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Division of Forest Insect Investigations

Station: Coeur d'Alene, Idaho

Period: Calendar Year 1939

Leader: James C. Evenden

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INTRODUCTION

Prevention of unnecessary damage to commercial and scenic forests, shade trees, and forest products is the responsibility of the Forest Insect Laboratory, Coeur d'Alene, Idaho. This responsibility is met through the study of insects injurious to forest and shade trees and the extension of entomological service to public and private timber and shade-tree owners. Studies of these insects have as their objective the development of direct or indirect methods of control which will reduce existing losses of commercial or scenic timber and prevent the development of destructive epidemics. The entomological service rendered by this laboratory varies from simple examinations of infested trees or shrubs to the examination and survey of forest lands, and assistance in the administration of artificial control. The responsibility of this laboratory is wide and diversified, with a variety of study projects and service activities.

The mountain pine beetle (Dendroctonus monticolae Hook.) holds the foremost economic position of the many forest insects within the northern Rocky Mountain region. Although the study and service activities associated with the different problems of this insect require practically the entire time of the laboratory personnel, an effort is made to prevent a total neglect of other problems and as much attention as possible is given to them.

Dr. F. C. Craighead, in charge of the Division of Forest Insects, spent the later part of July at this laboratory, at which time he inspected and gave valuable assistance in connection with the work of all field

projects. Dr. P. N. Annand and Mr. S. A. Rohwer, Assistant Chiefs of the Bureau of Entomology and Plant Quarantine, each visited the laboratory on August 9 and December 7 respectively. These visits are enjoyed and valued.

PROGRESS OF MAJOR LABORATORY PROJECTS

RESEARCH LINE PROJECT NO. h-1-1

INVESTIGATION ON THE HABITS AND THE DEVELOPMENT OF CONTROL METHODS FOR BARKBEETLES ATTACKING FOREST AND SHADE TREES.

The prevention of unnecessary losses of pine timber as a result of mountain pine beetle infestation is the most important problem of the northern Rocky Mountain region. Tremendous volumes of commercial timber are destroyed annually, scenic forests are seriously marred, forest types are changed, and severe fire hazards created which last for many years. In an effort to lessen the severity of this devastation, the following projects are being conducted at this laboratory:

Project No. h-1-1 (1)

Title - Studies of the character of individual trees and forest stands for the purpose of developing a basis for classifying such trees or stands as to their susceptibility to attacks by bark beetles.

Present Status - The isolation of characters which will permit the identification of individual white pine trees that are susceptible to attacks of the mountain pine beetle is made quite difficult by the fact that, as white pine stands are usually even-aged with co-dominant crown composition, one can not use the factors of age or dominance as a foundation for such a classification. Without these two important criteria of tree vigor one is obliged to base a decision upon the general appear-

ance of the tree, which includes the size and density of the crown. A cooperative project of utilization or selection cutting of white pine was instituted with the Northern Rocky Mountain Forest and Range Experiment Station during the past season. In connection with this project 710,000 board feet of dying and unhealthy white pine were removed from an area of about 250 acres on the Deception Creek Experimental Forest. It is estimated that all trees selected for this cutting would have died during the next five years.

Recent studies of mountain pine beetle infestations in white pine have contributed toward a better understanding of the susceptibility of certain age classes, the danger of open exposures, and the relation of type mixtures to subsequent bark-beetle damage. Stands of 80-year age class are relatively free from bark beetle attack. Heavy losses occur during the 100-160 age period, with scattered losses in the old over-mature stand.

Project No. h-1-1 (3)

Title - The biology and control of the mountain pine beetle (Dendroctonus monticolae Hopk.).

Present Status - Recent studies have clarified a question concerning parent adult emergence from individual white pine trees, which permits a clearer conception of the correction of survey data obtained prior to the end of the attack period. These data show that this emergence is not influenced by the diameters, density of attack, or bark thickness, but depends upon the percent that new adults making their first attack are of the total number of beetles making the initial attack of the tree in question. This information has established rather well the biology

of this beetle in white pine, although in its other hosts such items as parent adult emergence and reattack, overlapping of generations during abnormal seasons and at high elevations, and normal brood mortality are items to be determined when an opportunity for further study is available. The importance of the fact that more than one season is required for the development of a single generation of the mountain pine beetle in white-bark pine at high elevations is realized in the variation of foliage discoloration and the rather continuous period of attacks during the summer months. This information is of value in the execution of surveys to determine the existing status of such infestations.

Project No. h-1-1 (5)

Title - Investigation of the use of penetrating lethal oils in the control of bark beetles.

Present Status - Past experiments have demonstrated the effectiveness of certain penetrating sprays in destroying broods of the mountain pine beetle beneath the bark of lodgepole pine trees. However, the practical application to the entire tree as well as the cost of this potential method of control is yet to be determined. Valuable information concerning the application of this spray was obtained from a control project conducted on the Grand Teton National Park during the past season. This operation had as its objective the reduction of a potentially serious outbreak of the mountain pine beetle in lodgepole pine and the obtaining of data which would contribute towards a better understanding of the practical value of this spray as a standard method of control. Due to conditions peculiar to this project it was impossible to draw definite conclusions as to the efficiency or cost of this method of control. However, it is still believed that the following formula

will, when properly applied, not only destroy the insect broods but will be more economic in its application than other methods now in use:

Light fuel oil (28-32 Baume)	4 parts
Orthodichlorobenzene	1 part
Naphthalene flakes per gallon oil	3/4 pound

Project No. h-1-1 (6)

Title - Investigation on the practicability of increasing the percentage of control in bark beetle infestations by fostering parasites and predators during control operations.

Present Status - In all mountain pine beetle control projects in there are white pine trees where the population of parasitic and predacious insects is so heavy that any benefits to be derived through the treatment of the tree would be more than offset by the destruction of the beneficial insects. Although certain classes of these parasite trees can be isolated with a high degree of accuracy, they are the extremes and do not represent the trees containing the heavier populations of beneficials which should be preserved. Present studies indicate the non-importance of trees of small diameters (10 inches or less), as well as those occurring on dry open exposed sites, as producers of mountain pine beetle broods. The treatment of these trees is not warranted, as they contain more beneficial than injurious insects. Before control operations can be directed so as to obtain the greatest benefits from these beneficial agents data must be made available which will permit the recognition of "parasite trees" which should not be treated, as well as the relative values of the different parasites and predators.

Project No. h-1-1 (7)

Title - The biology and control of secondary bark beetles that under favorable conditions become of primary importance.

Present Status - In 1936 Ips oregoni and Ips ponderosa developed to epidemic proportions within the ponderosa pine stands of the Rocky Boy Indian Reservation in Montana. The reason for this outbreak was credited to a lowered tree resistance as a result of reduced precipitation, and a practice of logging which left logs in the woods, which the beetles used as host material in breeding to tremendous numbers. With a return to a near-normal precipitation and the correction of logging methods, the severity of the Ips outbreak was materially reduced. The area was examined during the past season with very few new attacks recorded. The elimination of damage to forested area by outbreaks of these secondary bark beetles is now recognized as a matter of prevention through the adoption of proper cutting regulations and not through the direction of artificial control against existing outbreaks.

Project No. h-1-1 (8)

Title - The protection of individual pine trees of high value from bark beetles.

Present Status - The work of this laboratory has been confined to the possibility of protecting lodgepole pine trees during epidemics of the mountain pine beetle. The plan of operation for this problem was based upon the fact that the initial attack of the insects is directed against the basal portion of the bole, and if this basal attack could be prevented none would occur in the upper portion. Although a number of deterrent sprays and pastes were tested, the only success obtained was by enclosing the base of the tree in a wire screen envelope. Trees screened in 1934 and 1935 have successfully prevented attacks of the mountain pine beetle during the life of epidemics in those areas. A

series of trees around the headquarters buildings of the Grand Teton National Park were treated in 1938 and have not been attacked during the past two seasons, although trees immediately adjacent to them were attacked during the past season. The treatment offers an economical method of protecting such trees.

Project No. h-1-1 (10)

Title - Collection of data on bark-beetle populations which not only will be of value in advising control but will be useful in studying the trends of infestation and the causes therefor.

Present Status - The scope of this project is quite large, as it involves the detailed analysis of mountain pine beetle broods in western white pine under all classes of infestation and forest conditions, which provides a large volume of data applicable to other laboratory studies. During the past four field seasons 820 infested white pine trees have been felled and intensive samples of brood conditions taken at stated intervals along the infested portion of the bole. These data have permitted the forming of rather definite conclusions regarding some of the factors influencing infestations of this insect, and are of value in determining policies of control. Some of the conclusions drawn are as follows:

1. Trees of and below 10 inches d.b.h., regardless of the intensity of attack, only show an average of 3.9 beetles per square foot of bark surface. As in these trees the average population of parasites and predators averages 3.9 and .4 per square foot, the elimination of these trees from control projects is advisable.

2. The emergence from trees growing on dry exposed sites is hardly sufficient even under favorable conditions to maintain an infestation at a constant level. The average emergence from trees on such sites is but 8.5 insects per square foot of bark surface, and is a decrease from the 9.8 beetles originating the average attack. Furthermore, there is an average of 2.3 parasites and .5 predators per square foot, which makes the treatment of this class of trees an unwarranted procedure. As these infested trees usually occur as singles along high ridges, where treatment is an expensive operation, their elimination from a control project is a material step in the reduction of costs.

3. Data have been obtained which permit the use of a correlation between the density of attack, brood status, brood mortality, and volume of infested bark surface, as an indication of the subsequent trend of the insect population. Although not infallible at this time, practical tests of these data have demonstrated their value.

4. Although of no immediate value at this time, this study has provided information relative to the interrelation of tree diameters and bark thickness to the density of attacks, brood conditions, and the population of parasites and predators. These data provide an appreciation of the fundamentals of this problem, upon which a correct answer can be established.

RESEARCH LINE PROJECT NO. h-1-3

INVESTIGATIONS ON THE HABITS AND THE DEVELOPMENT OF CONTROL METHODS FOR INSECTS WHICH BORE THROUGH THE WOOD AND BARK OF LIVING FOREST AND SHADE TREES.

Project No. h-1-3 (2)

Title - The biology and control of the locust borer, with special attention to the effect of draught and the possibilities of silvicultural treatment for control.

Present Status - No work on the project.

RESEARCH LINE PROJECT NO. h-1-6

STUDIES ON THE RELATION OF CLIMATIC FACTORS, SUCH AS HEAT, COLD, MOISTURE, ETC., ON FOREST INSECT POPULATIONS.

Project No. h-1-6 (1)

Title - The effects of low temperatures on bark beetle populations.

Present Status - To obtain data contributing toward a better understanding of temperature conditions which result in an abnormal mortality of overwintering mountain pine beetle broods, a series of controlled experiments have been conducted at the Coeur d'Alene Laboratory during the past three winters. Data obtained from these experiments have shown that periods of extreme low temperatures, regardless of their duration, cause little if any abnormal mortality of overwintering mountain pine beetle broods if they occur during normal seasons of the year. These experiments have shown that as fall temperatures occur the insects develop a cold-hardiness which follows quite closely the normal changes of temperature. The resistance of these insects reaches its maximum in December or January, where it remains until spring temperatures occur, when it gradually decreases to a degree comparable to that which existed the previous September. During the period of maximum cold-hardiness, mountain pine beetle larvae withstood exposures to temperatures as low as -40 degrees. Other experiments have shown that this period of cold-hardiness can be broken by a period of warm abnormal weather during the winter, and that if followed by normal winter conditions, before larval

resistance could be rebuilt, severe brood mortality would follow. As a result of these data the mountain pine beetle is considered as being able to withstand the extreme low winter temperatures of this region but susceptible to unseasonal weather conditions.

Past experiments have been largely conducted with naked larvae, which is subject to the criticism as depicting unnatural conditions. In an attempt to operate under natural conditions, infested white pine logs are now being used for each exposure. After exposure the logs are stored in an insectary and in the spring will be placed in cages to determine the actual emergence. It is hoped that this experiment will establish beyond question the seasonal cold-hardiness of the mountain pine beetle.

RESEARCH LINE PROJECT NO. h-1-8

INVESTIGATION ON THE INJECTION OF CHEMICALS INTO THE SAPSTREAM OF THE TREE FOR THE CONTROL OF BARK BEETLE INFESTATIONS AND FOR THE TREATMENT OF GREEN TREES TO PREVENT INSECT ATTACK UPON THE UTILIZED WOOD.

Project No. h-1-8 (2)

Title - Investigation of methods and of the effectiveness of introducing chemicals into bark-beetle-infested trees for the purpose of killing the insects.

Present Status - Following the erratic results obtained from the treatment with copper sulphate of a large series of white pine trees infested with the mountain pine beetle in 1937, a few green trees were treated in the fall of 1938 to test the distribution of this chemical, as well as its effectiveness in preventing the attack of secondary insects. Three strengths of copper sulphate, 4 oz. and 1 oz. per cubic foot of wood and 1/2 oz. per diameter inch, were used in these injections. The last formula (1/2 oz. per diameter inch) had given successful results in

1935, but failed in 1937. As a further check on its effectiveness six beetle-infested trees were also treated with this formula. These treatments, with the exception of the infested trees, were duplicated in the spring of 1939.

These trees were felled and examined in July 1939, with no definite visual conclusions as to the distribution of the copper sulphate being possible. The same erratic results relative to insect mortality within the insect-infested trees were also recorded. Wood samples have been taken from these trees to obtain a ^{it}quantitative analysis as to the distribution of copper. These data have not been received.

In the fall of 1939, five infested white pine were treated with sodium arsenate and five with ammonium bifluoride. The dosage of these chemicals was but 1/25 of the heavy dosage of copper sulphate previously employed. These trees will not be examined until June 1940. From the inconsistent results obtained it is evident that there is some factor or combination of factors which influences the distribution of the introduced chemicals.

RESEARCH LINE PROJECT NO. h-1-13

SURVEYS TO LOCATE AND DETERMINE THE STATUS OF INSECT PESTS OF THE FORESTS AND THE GIVING OF ADVICE TO LAND-MANAGING AGENCIES ON PLANNING AND CONDUCTING NECESSARY CONTROL WORK.

Project No. h-1-13 (1)

Title - Surveys to determine the advisability of control in national forests, national parks, Indian lands, and state and private lands.

Present Status - The first requirement in preventing excessive losses of timber resulting from outbreaks of forest insects is an

organized and adequate system of forest insect surveys. Data from these surveys permit an early detection of potential outbreaks, and the subsequent institution of control at a time when the greatest benefits will be derived from a minimum expenditure. Although during the past three years this project has developed to a point where essential and valuable information is provided, the scope of the project still fails to satisfy the requirements of the region. Due to its value and the seriousness of the existing infestations, the greatest consideration has been given to the white pine forests of northern Idaho and western Montana. During the past three seasons an average of 37 percent of the total white pine acreage has been covered, which is but 60 percent of the area that should be included in each year's survey program. Of the total timbered acreage of this region, that which includes all timber species should be considered in a survey program, the acreage covered during the past three years has only averaged 7.1 percent, which is but 35 percent of the area that should be covered each year. Until this project is developed to its proper magnitude the early stages of bark beetle outbreaks within the different timber types of the region can not be detected. Charts 1 and 2 depict the needs of the region in a graphic form.

During the 1939 season surveys were conducted on the following forested areas:

FOREST	ACRES	TIMBER SPECIES	INSECT
Coeur d'Alene	118,730	White pine	Mountain pine beetle
Kaniksu	180,460	" "	" " "
Cabinet	3,740	" "	" " "
Salmon	83,680	Ponderosa pine	Western pine beetle
Weiser	69,720	" "	" " "
Shoshone	21,461	Douglas fir spruce	Douglas fir beetle
Glacier Nat. Park	279,000	Mixed	Mountain pine beetle Douglas fir beetle
Teton Nat. Park	4,000	Lodgepole pine	Mountain pine beetle
Total	760,791		

Although past survey programs have been inadequate for the region, information has been made available concerning the status of the mountain beetle infestation within the most important white pine areas of the region, which is a forward step in the prevention of excessive timber losses, and it is hoped that this project can be extended to include all forested areas.

Project No. h-1-13 (2)

Title - Surveys to check up on the results of control work that has been performed.

Present Status - During the spring of 1939, control projects were directed against outbreaks of the mountain pine beetle within specific white pine stands of the Clearwater and Kootenai National Forests. On the Clearwater National Forest a total of 3,031 infested trees were treated at a cost of \$21,973, or \$7.14 per tree, while on the Kootenai National Forest 1,118 infested trees were treated at a cost of \$6,928, or \$6.19 per tree.

The check survey of the Clearwater units showed that the 1939 infestation only amounted to 30 percent of the number of trees treated; however, on the Kootenai control areas the number of newly infested trees amounts to 56 percent of the number treated, which is not a satisfactory reduction.

On the Shoshone National Forest, where 4,299 Douglas fir trees infested with the Douglas fir beetle were treated during the winter of 1938-39, the infestation was reduced to 2,073 infested trees, with a marked reduction in the severity of the attacks.

On the Grand Teton National Forest 1,450 out of a total of 1,858 lodgepole pine trees infested with the mountain pine beetle were treated with a penetrating spray. A recheck of this area in September shows the 1939 infestation to be 1,120 trees, which is perhaps as great a reduction as could be expected under the circumstances peculiar to this operation.

RESEARCH LINE PROJECT NO. h-1-16

DISSEMINATION OF INFORMATION TO THE PUBLIC ON METHODS OF CONTROLLING FOREST AND SHADE TREE INSECTS, INCLUDING GENERAL INQUIRIES ON THE SUBJECT.

The cooperative entomological service extended by this laboratory during the past year required considerable time on the part of the laboratory personnel. These requests varied from letters, telephone calls, and office visits, to the examination of forested areas, shade and ornamental shrubs, and assistance in the administration of artificial control.

Cooperative Service Extended on Control Projects

	<u>Time Extended</u>
Clearwater National Forest	35 man-days
Kootenai National Forest	9 man-days
Coeur d'Alene National Forest	30 man-days
Grand Teton National Park	40 man-days

Cooperative Field Examinations of Forested Areas

Absaroka National Forest May	Englemann spruce beetle infestation-Pine Creek Campground.
White Pine Experimental Forest June	Marking trees susceptible to bark-beetle attack in experimental selective logging project.

Potlatch Lumber Co.
June

Examination of experimental methods of slash disposal in their relation to subsequent insect infestations.

Shoshone National Forest
June

Examination of Douglas fir trees in Cody Canyon to determine need for spraying against spruce budworm.

Targhee National Forest
July

Instructions to timber survey crew relative to recognition and age of Douglas fir beetle attacks.

Private Estate--
Palouse, Washington
July

Several shade tree insects, and prior scorching of spruce trees by an oil spray.

Sawtooth National Forest
July

Examination of tussock moth infestation in Douglas fir.

Shoshone National Forest
August

Douglas fir beetle infestation in Clark Fork drainage.

White Pine Experimental Forest
August

Injury to trees along newly constructed road by insects.

Glacier National Park
August

Examination of Campgrounds, and dying of trees along road sides.

Gallatin National Forest
September

Examination of campgrounds along Gallatin River.

Cabinet National Forest
September

Examination of injury to white pine plantation (Pineus pini-foliae).

Cabinet National Forest
September

Examination of injury to ponderosa pine plantation (Matsucoccus sp.).

In cooperation with the Japanese Beetle Laboratory at Bloomfield, New Jersey, Japanese beetle traps were maintained during the season.

Ten lectures on forest insects were given to different organizations.

Scientific Meetings Attended:

Rocky Mountain Entomological Conference,
Science Lodge, Colorado. J. C. Evenden

Northwest Scientific Association, December 27-28.
J. C. Evenden, W. D. Bedard.

COEUR D'ALENE LABORATORY INSECTARY

Scope - Rearing of forest and shade tree insects to obtain material for determination and to establish relationships between larval and adult forms.

Present Status - This work has been conducted at a new insectary located at the Coeur d'Alene Ranger Station, which is just outside the city limits. A list of the insects reared follows:

<u>Order and insect</u>	<u>Host</u>	<u>Locality</u>
Coleoptera		
*Flathead wood borer	Ponderosa pine	Riggins, Ida.
Melanophila californica Van Dyke	" "	
*Spondylis uniformis Mann.	White pine	Coeur d'Alene, Ida.
Hymenoptera		
*Hyposoter pallipes (Prov.)	Douglas fir tussock moth	Hailey, Ida.
*Platycampus (Anoplonyx) laricis Roh.	Larix occidentalis	Granite, Ida.
*Platycampus (Anoplonyx) laricivorus Roh.	" "	" "
*Parasite of webworm	Hyphantria textor Harris	Hope, Ida.
**Larch Sawfly	Larix occidentalis	Thompson Falls, Mont.
**Parasite of webworm	Hyphantria textor Harris	Hope, Ida.

<u>Order and insect</u>	<u>Host</u>	<u>Locality</u>
Lepidoptera		
*Hyphantria textor Harris	Alder	Kootenai, Ida.
Hyphantria textor Harris	Alder & Chokecherry	Hope, Ida.
*Box Elder Leaf miner	Box elder	American Falls, Ida.

Diptera		
*Parasite	Platycampus	
	(Anoplonyx) laracis	Granite, Ida.
**Parasite	Hyphantria	
	textor	Hope, Ida.

*Overwintering 1938-39

**Overwintering 1939-40

PERSONNEL

Permanent Employees

<u>Name</u>	<u>Title</u>	<u>Assignment</u>
James C. Evenden	Entomologist	General administration and technical charge of laboratory; supervision of research projects; administration of cooperative service activities; climatological factors and bark-beetle populations.
William D. Bedard	Associate Entomologist	Bark-beetle control by tree injection; biological factors of control; behavior of mountain pine beetle infestation in white pine.
Archie L. Gibson	Assistant Entomologist	Forest insect surveys; bark-beetle control by penetrating sprays; protection of individual trees from beetle attack; behavior of mountain pine beetle infestation in lodgepole pine.
Henry J. Rust	Senior Scientific Aide	Insectary; study of shade tree insects; general work as assigned.
Tom T. Terrell	Scientific Aide	Forest insect surveys; cooperative service work on control projects; laboratory technician on low-temperature studies.
Laura B. English	Clerk-Stenographer	Charge clerical and fiscal matters.

PERSONNEL

Temporary Employers^e

<u>Name</u>	<u>Title</u>	<u>Period</u>	<u>Assignment</u>
Verne L. Hruska*	Clerk	1/1-6/24/39	Stenographic and general office duties
Doyne M. Skinner*	"	8/9-9/18/39	Typing and general office duties
Ruby McArthur*	"	12/8-31/39	Typing and general office duties
Clebern R. Clumpner	Agent	8/1-10/3/39	Bark beetle surveys
Lee. E. Frantz	Field Aide	10/19-31/39	" " "
Carroll D. Heath	Agent	8/1-11/2/39	Chief of party, bark beetle surveys.
Marion S. Hulse	Field Aide	10/19-31/39	Bark beetle surveys
Jess W. Langford	Agent	8/1-10/31/39	" " "
Reynold H. Peterson	Cook	8/1-10/20/39	" " "
J. Dean Prater	Field Aide	10/19-31/39	" " "
Glen H. Richardson	Agent	8/1-11/7/39	Chief of party, bark beetle surveys.
George W. Rounsovell	"	8/1-10/31/39	Bark beetle surveys
Harry P. Scarborough	"	8/1-11/6/39	" " "

* Salaries paid by Forest Service from ERA allotment

Cooperators

Forest Service -- Officers of the Forest Experiment Station, Regional Offices, and forests throughout the territory covered by this laboratory.

Division of Plant Disease Control, Spokane, Washington

Cooperators
(continued)

Soil Conservation Service, Spokane Washington

Department of Interior, National Park Service -- Yellowstone, Glacier, and
Teton National Forests.

Office of Indian Affairs, Forest Service, Spokane, Washington

University of Idaho, School of Forestry, Moscow, Idaho

Forest Insect Laboratories, Bureau of Entomology and Plant Quarantine.

CHART 1

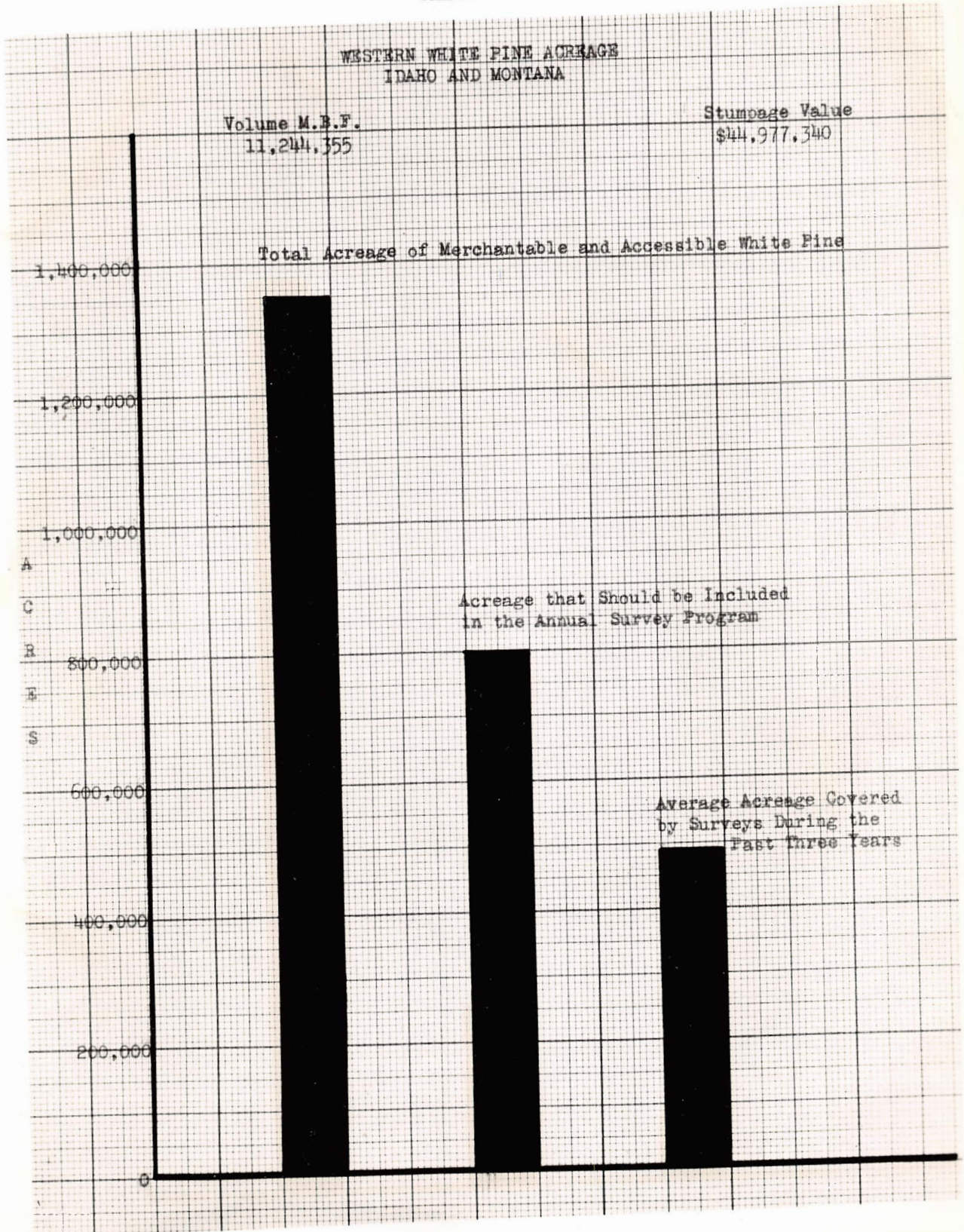


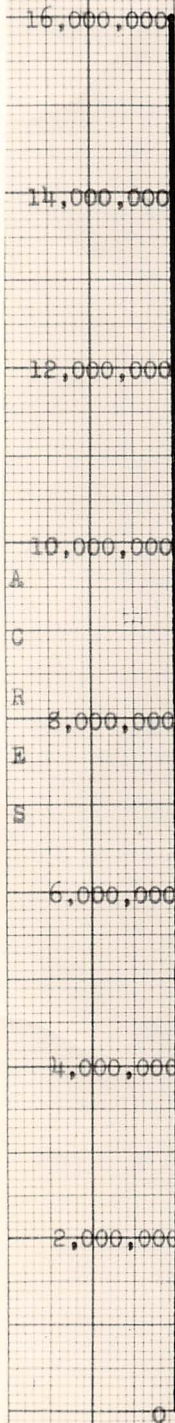
CHART 2

COMMERCIAL TIMBER ACREAGE IDAHO AND MONTANA

Volume M.B.F.
62,319,775

Total Acreage of Merchantable and Accessible Timber

(Western White Pine
(Ponderosa Pine
5 species (Lodgepole Pine
(Douglas Fir
(Engelmann Spruce



Acreage that Should be Included
in the Annual Survey Program

Average Acreage Covered
by Surveys During
the Past Three Years